Pathways

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TREES

Man needs trees. A list of all the things in our environment that come directly or indirectly from trees would be legion and evidence of great material dependence. And this dependence is greater than many realise, for if all the trees were suddenly removed from earth, the intricate machinery of ecological balance would be thrown out of gear and our continued existence threatened.

But there is more to trees than utilitarian value. They are vital elements in our visual landscape, which delight the eye and evoke aesthetic response.

Clearly, trees play an important part in the life of man, and this is a very good reason for including them in school work. But there is another, equally valid reason for their inclusion in classroom activity. They provide a ready source of material for observation and investigation which is likely to further the development of children's scientific understanding.

—from 'Trees'; by Shiela Parker—Science 5-13 Series.

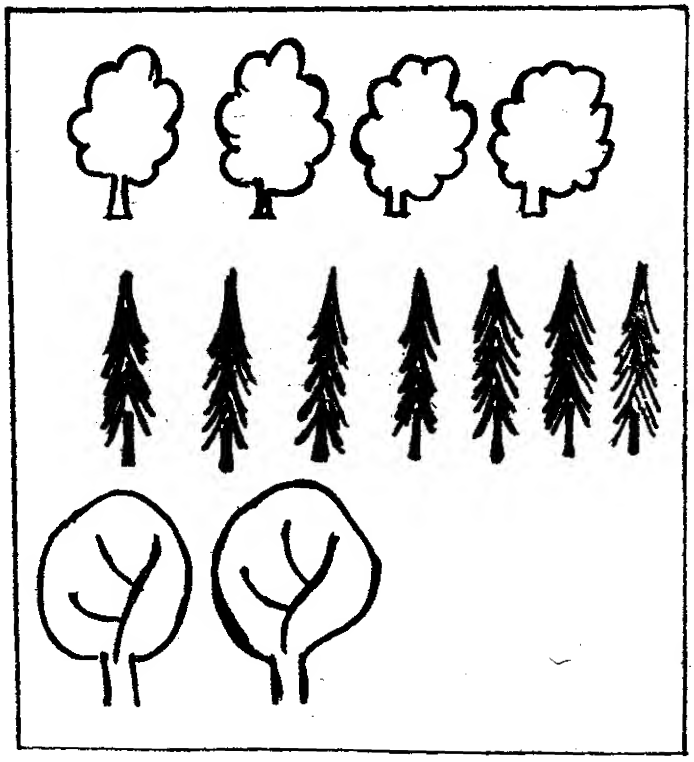
Starting Points for a Study of Trees : Readers will find it useful to first make a survey of trees in their own school or in the neighbourhood. The activities may relate to trees found in a school playground or park; or sometimes one particular tree which is being closely observed and studied by a child or a small group of children.

The right time to start the project is when something interesting is happening - the first flower is seen, the leaves are falling, or perhaps the leaves are changing colour. Less obvious things like the ants creeping up the trunk of a tree, the building of a bird's nest or the hatching of young birds in the branches of a tree may be brought to the notice of the children Collections made by the children of leaves, fruits, barks and seeds may prove the starting point All these lead to classroom discussion, which in turn produces interest in finding out more In the pages that follow, answers to some of the questions and ways of carrying out experiments are given for the benefit of the teacher. It is a good idea not to reveal these straightaway, but to ask questions and wait for children's suggestions and solutions to problems.

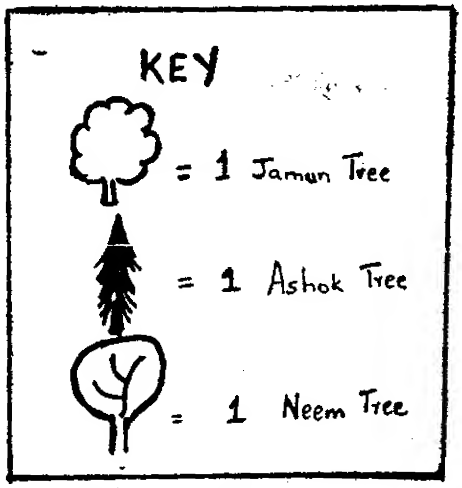
A Word of Caution : Ensure that activities which require collection of leaves, flowers etc. do not result in damage to trees or the accumulation of too many specimens which will only end up in a wastebin.

Trees in the School Playground or a Neighbourhood Park

1. **Tree Surveys can be made and the results** obtained represented in a variety of ways—cut-outs, pictographs, block graphs. Gardeners are useful friends—they not only tell us the names of the different types of trees but are a mine of information about what trees need, how they grow, what they look like at different parts of the year and also about birds and insects.



A PICTOGRAPH SHOWING THE TREES IN MY SCHOOL



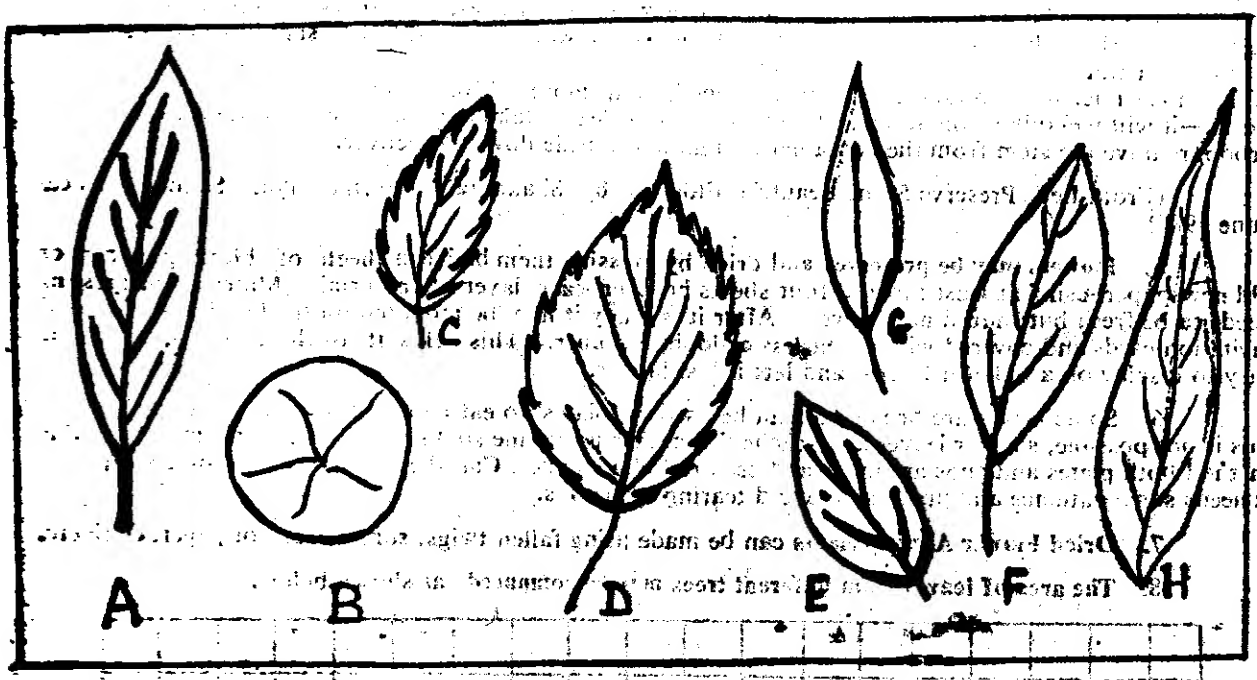
1 symbol = 1 tree

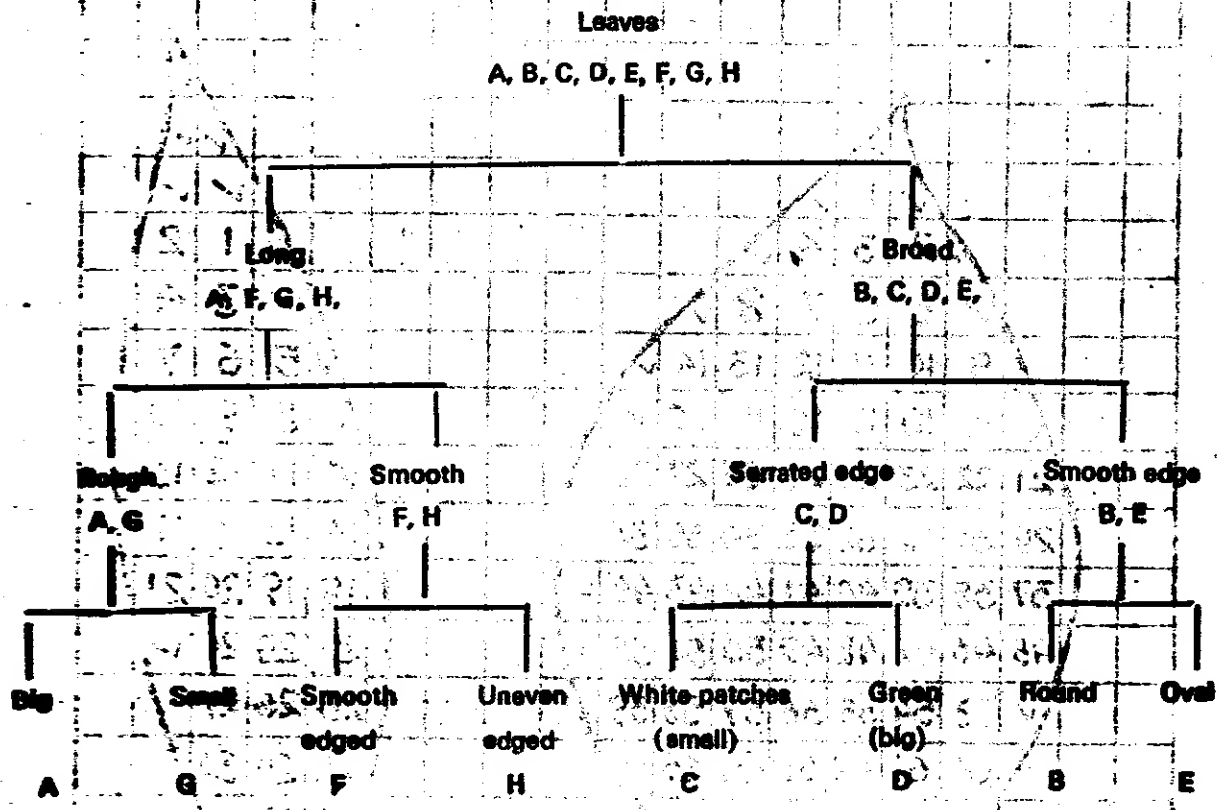
A survey may help to find more than one specimen of the same tree. A **comparative study** might prove interesting—are they of the same age, height, thickness? Do they differ in any way? Do the same kinds of insects (or birds) live on them or near them?

Can a group of children make **a map** to show the location of the different trees? These would lead to development of the skills of careful observation, measurement in paces or using a tape measure, the understanding of the concept of scale and pictorial representation using symbols. If this proves too complicated a task for them, perhaps it need not be drawn to scale.

2. **Collections of leaves, flowers, fruit may be made by the children.**

How can these be classified—colour, size, shape, season, type of tree from which obtained (evergreen, coniferous, deciduous), whether edible or not, texture, leaf edges, thickness of leaves . .....?





3. Leaves may be placed below a sheet of white paper and crayons of different colours rubbed over the paper to obtain leaf prints. These may then be assembled into interesting patterns or collages. Similarly, paper may be placed on bark and a brown crayon rubbed over the paper to get a bark rubbing. Can these form the basis of an identification quiz for trees?

4. **Leaves of trees may be preserved** by treating them with a solution of glycerine and water (one part glycerine to two parts warm water, well-stirred). Glycerine can be easily obtained from chemists shops. Choose branches with a good arrangement of leaves. Leathery leaves are particularly suitable e.g. Magnolia. Before standing it in the glycerine-water, all material should be cleaned Split up the stem ends of hardwood branches so that they may better absorb the solution. A depth of 15 cm of liquid is sufficient. Should it all be absorbed, add more. Most foliage is ready in two to three weeks—it will feel oily to the touch. Plants with thin leaves take less time. Should the leaves start to droop, remove the stem from the container and hang it upside down to recover.

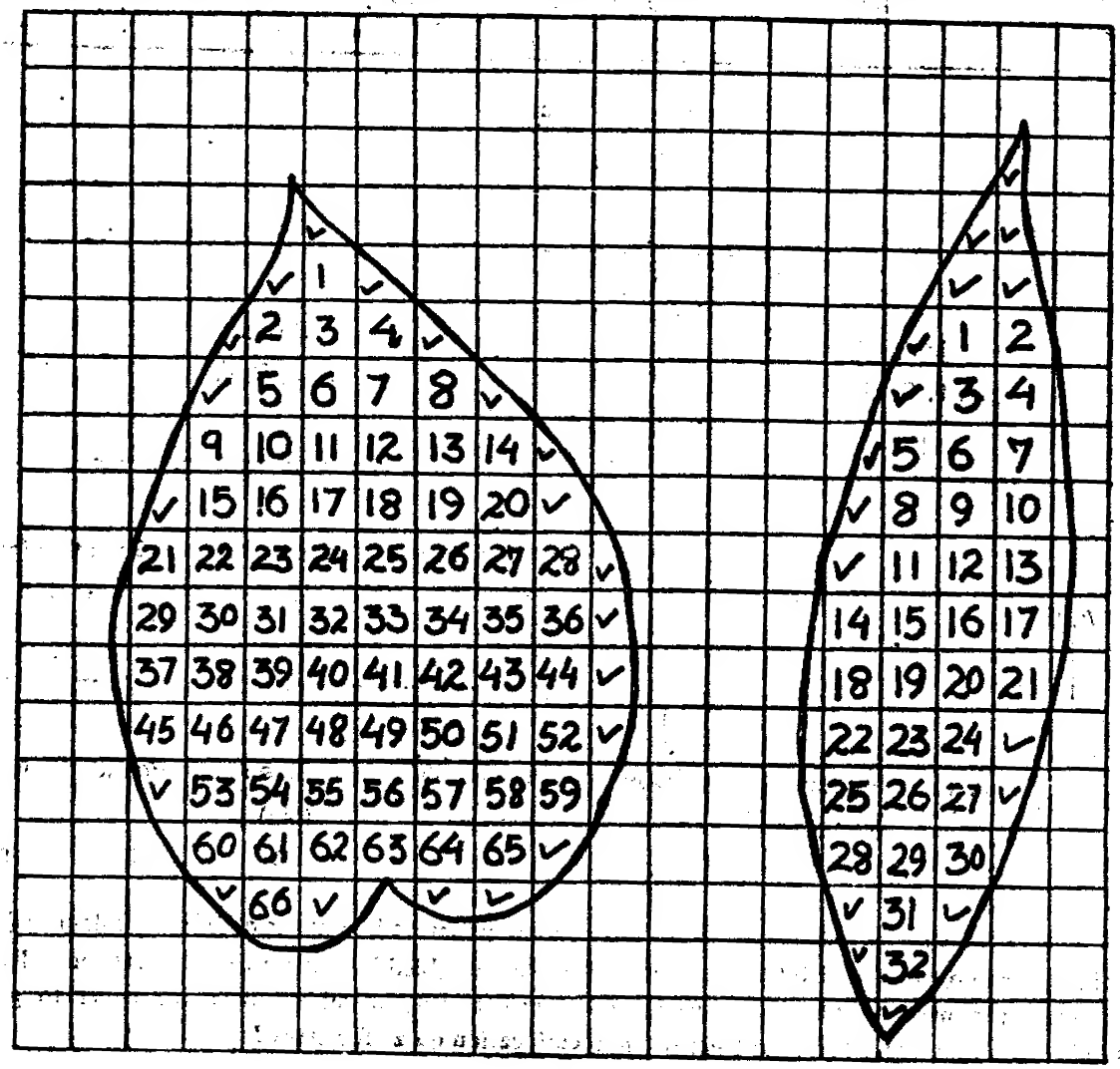
(From Let's Preserve Some Beautiful Flowers by Shakuntala Bhattacharya. School Science-June 1980)

5. **Flowers may be preserved** and dried by pressing them between sheets of blotting paper or old newspaper–using at least three to four sheets between each layer of material. Material for pressing needs to be fresh but should not be wet. After it is ready it may be mounted on the blank side of used invitation cards and covered with colourless cellophane paper. This helps it to look good, makes it easy to display on a bulletin board and lets it last longer.

6. Some leaves are broad and can be used as 'plates' to eat from. Can you name any? When this is not possible, smaller leaves are 'stitched' together using fine sticks from a new broom. With this method both plates and cups are made and used in Indian homes. Can the children make some samples—it needs some patience and practice to avoid tearing the leaves.

7. **Dried Flower Arrangements** can be made using fallen twigs, some scraps of paper, cloth etc.

8. **The area of leaves from different trees may be compared** as shown below.



All the complete squares are numbered. Squares that are half or more than half are marked with a tick-mark.

Leaf Number 1

Number of whole squares = 66
Number of squares with a tick = 20

Area of leaf = $66 + \frac{20}{2} = 66+10$

= 76 squares

Leaf Number 2

Number of whole squares = 32
Number of squares with a tick = 16

Area of leaf = $32 + \frac{16}{2} = 32 + 8$

= 40 squares.

Leaf 1 is bigger than Leaf 2 by 76 — 40 = 36 squares.

9. How many trees in the neighbourhood have been damaged by vandals ? How? The children can build up a dossier on this.

10. Talking to people who have lived in any area for a long time may lead to impressions (perhaps even pictures or photographs) of how that area looked about ten or twenty years ago. Were there more trees ? What kind ? What did the area look like ? When were the trees chopped down ? Why ? Did all the buildings in the area (and the roads) come up around the same time ? Has any tree survived all these changes ?

11. Find out how scientists tell the age of trees ? each When a tree is chopped down, annular rings may be seen each one representing one year in the life of the tree.

12. Find out interesting stories about trees. Two of Aesop's fables are given below

The Plane Tree and the Travellers

Two travellers exhausted by the heat of the day, laid themselves down at mid-day in the pleasant shade of a Plane-tree. As they rested under its spreading branches, one said to the other, "What a very useless tree a Plane is ; it bears no fruit, nor flowers, nor is it of any service to man at all!"

"What", cried the Plane-tree, "are you so ungrateful that even while you enjoy the shade of my branches to refresh yourselves, you dare to call me useless ?"

The Walnut Tree

A Walnut Tree growing by the roadside, bore a very large crop of nuts. Many of the passers-by stopped to break the branches with sticks and stones in order to bring down the abundant fruit.

The Walnut Tree, sorely wounded, cried, "Alas poor me ! To think that the very people whom I please with my fruits should be the first to hurt me with their blows."

13. Plan a mini Vana-Mahotsav for your class—perhaps each group could plant one tree and care for it. Initial discussions will help the class to decide where trees are needed in the school, what purpose they will serve—provide shade or remain ornamental ? A site will have to be selected—perhaps with help and advice from the gardener. Information is needed about the amount of sun and wind the tree will get, the season in which it should be planted and whether the soil is the right type. A visit to a nursery will reveal the wide range of trees available. A catalogue may be available or professional help-to make a short list of suitable trees. Based on the factors mentioned above and the cost of the

sapling the group can decide which tree to plant. If more than one tree is to be planted, the distance between them needs to be checked on. A list must be drawn up of materials needed for planting—compost, tools required. How big and deep is the hole to be? Should the tree be close to a wall or building-if not, how far away?

The hole is prepared. The soil mixed with compost and the hole re-filled. And finally . . . the planting ceremony!

14. Trees are commonly used as motifs in pictures, wall decorations, tapestries and cloth of various kinds. How many such examples can the children find?

What about a wall frieze showing different kinds of trees seen in the neighbourhood?

15. **Paper sculptures.**

Using overlapping sheets of paper in shades of brown and green make up a cylindrical roll. This may be cut in different sizes to give trees of differing heights. Make vertical cuts downwards at the top end of the tree and fold the 'streamers' so formed backwards to make the foliage of the tree.

16. **Find out the meanings of these words:**

Arboriculturist; horticulturist; entomologist; apiarist; ornithologist; lepidopterist.

17. **Find out something about these trees:**

Bao-bab; Banyan; Redwood; Monkey-puzzle; Mangrove.

A Crisis in the Himalayas

Tehri Garhwal, a northern hill district of U.P. is in the throes of crisis today!

The Garhwali's lives depend, in one way or the other solely on forests. Fuel wood to cook and keep warm in winter, fodder for their cattle; leaf compost for their fields; water for agriculture, drinking and washing; grasses and fibre for baskets, mats and clothes; wood for construction and tools; herbs for healing diseases—all come directly from the forest. As importantly, these forests bind the soil and keep it rich with leaf manure; guard against natural disasters like landslides, floods and droughts. They are, in effect, Garhwal's lifeline.

Today the natural broad-leaved or mixed forests of such immense value are diminishing. Hills once covered with thick forests of oak and rhododendron trees, ferns, mosses and creepers now have instead huge jagged scars, landslides and dull, sparse clumps of the stately but useless chir pine. The chir pine is commercially valuable for its timber and the resin sap used in chemical factories. It grows easily; but its needle-like acidic leaves form a thick carpet on the ground which allows no undergrowth and does not become a useful fertiliser. Chir trees have little water retaining capacity, so they do not replenish the natural streams which are so abundant in broad-leaved forests. Thus a shortage of all the neccessities in the Garhwalis' lives is the tragic result of deforestation and large-scale plantation of pines.

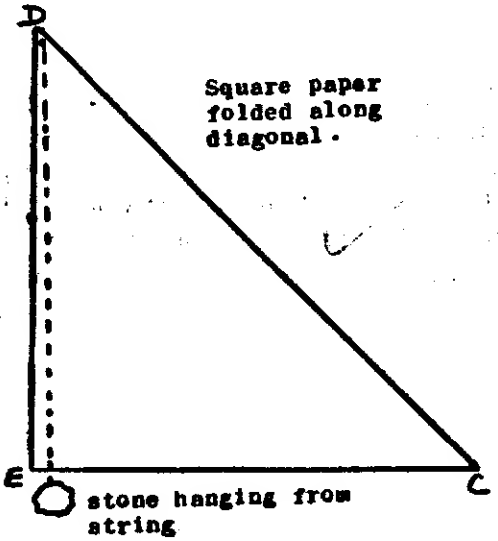
The Chipko movement arose as a result of the enormous suffering caused to the local people on account of this change in their hills. Women in the area have taken the lead in protecting the few natural forests which still remain. At times they cling to the trees ('Chipko') when axemen approach to

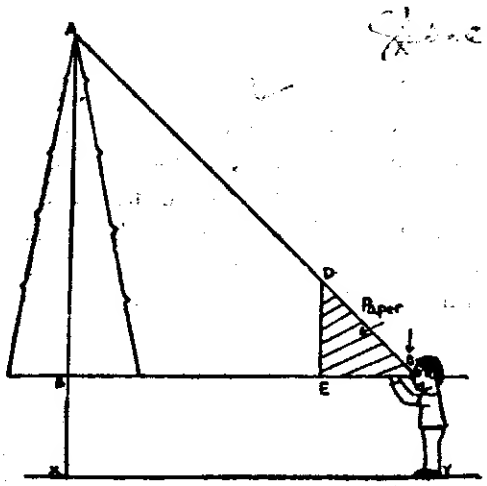
cut them down. They have appointed guards to protect their trees and fined local offenders. They have even adopted trees by tying 'rakhis' around them to show their willingness to protect them.

—Adapted from 'Crisis in the Himalayas' by Ashish Kothari. Nature, The Environmental Action Newsletter; October 1980.

18. Groups of children in the class can 'adopt' trees–either in the school playground, the neighbourhood or perhaps in the residential colonies where they live. They will accept the responsibility of watering them, protecting them from vandalism and thereby enjoy the flowers, fruit and shade of their own special trees.

Activities involving a Particular Tree chosen by the Students





19. A simple way of measuring the height of trees is outlined here.

A piece of paper 20 cm square is taken and folded along its diagonal to make a right-angled triangle. The plumb line is added as shown in the figure. This simple device helps the student to hold his clinometer correcty. The edge DE is exactly vertical if the string hangs parallel to it. Obviously this will keep CE parallel to the ground. The triangle is placed at eye-level and the student walks backwards from the tree till its topmost point is in line with CD.

Angle B = Angle E = 90° ; AB = BC
Height of the tree = AB + BX = BC + BX = XY + CY
The height of the tree = The student's distance from the tree + the height of the student.

20 Apart from measuring the height of the tree, an estimate of its girth could be made .... how many handspans ? how many centimetres ? Actual measurement will prove if the estimate is reasonable. If other specimens of the same tree are available the girths of the different trees can be compared.

21. Autumn and winter provide opportunities to look at leaves falling. Children can stand under the tree and look really closely at the leaves as they fall. What words could be used to best describe their movements? Can anyone catch a falling leaf? Can we hear it fall ? Do more fall on one side than on another ? Why ? Does the shape of the leaf have anything to do with how fast it falls ? Do the leaves dry up fully before they fall ? Are all the falling leaves of the same size ?

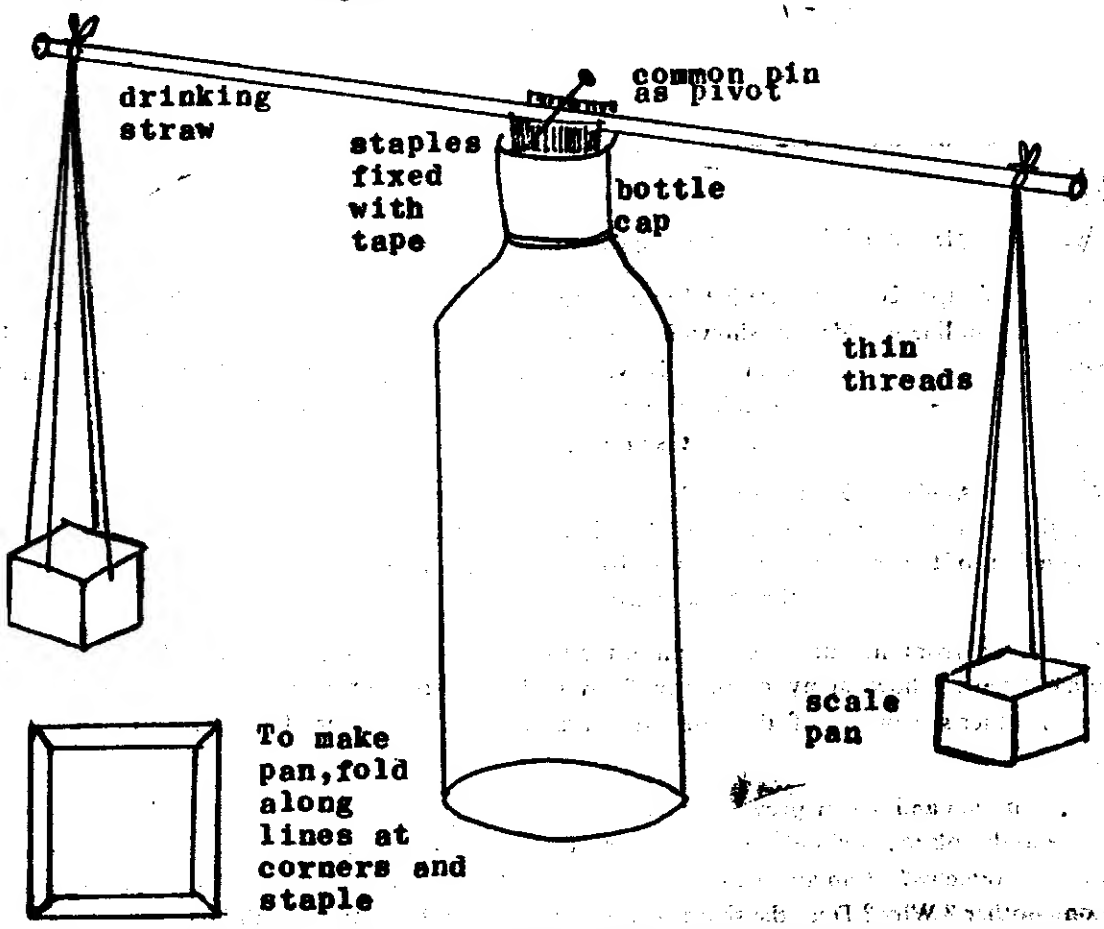
22. Looking at the fallen leaf litter can lead on to discussions on the decay of leaves and the formation of compost .... conversations with the gardener.

23. Comparison of leaf areas can be done by the method outlined in activity 8. An extension of the same idea would be to make a half-centimetre grid and find how the area changes as a particular marked leaf grows. If children are skilled with their hands they could make this grid by winding thread around a piece of stiff card with notches cut along all four edges at distances of ½ cm or perhaps even ¼ cm. This 'block' could be dipped in indelible Indian Ink and stamped on a young leaf. As the leaf grows the 'squares' on the grid expand and when full-grown can be measured again to find the increase in area. The chosen leaf may be identified by putting a small name tag on its stem or a paint spot on both its surfaces.

24. Finding the thickness of leaves poses another problem. The children should be left free to make suggestions. The measuring of the height of a counted stack of leaves in millimetres will give the answer.

25. Other challenges that may be offered include .... finding the smallest leaf ... the biggest leaf .... the branch with the most or least leaves ..... All such exercises lead to careful observation.

26. Are dry leaves the same weight as the green ones? Experiments in weighing can be carried out using the balance shown below. It may be constructed by the students using a discarded shampoo bottle, a drinking straw, a common pin, some staples and a little cellotape. The scale pans are made of chart paper squares folded neatly at the corner and stapled as shown. 'Weights' may consist of grains of rice, dals or for very light leaves mustard seeds. The 'weights' are used to balance the green leaf at the start of the experiment. The leaf is then dried out slowly by placing it in a warm oven or on a hot 'tava'. It is then re-weighed.



Further details about the construction of the balance may be obtained from Science in Action, 2 by M. A. Paranjpe; MacMillan Company of India Ltd.

27. Twigs kept in jars of water in the classroom can lead to investigations. What happens to the water level? Where did the water go? (To prevent evaporation a thin layer of oil may be put on the water). Experiments using a coloured dye or ink in the water might be used to trace its movement in the twig. Such experiments can lead to much discussion on the need for a fair judgement, the need to exclude other possibilities and to perform all tests under controlled conditions.

28 Finally a study of a particular tree can also lead to finding out about insects, animals and birds living on or near the tree.

Birds and their nests . . . how they are built . . . the hatching of young ones . . . how they learn to fly . . . .

Ants and their trails . . . watching them climb the bark . . . carry food to their homes . . . how they always find their way back to the trails . . . . . .

Squirrels . . . their games and antics . . . their alarm calls . . . their food . . . . their homes . . .

Insects in the leaf litter at the base of the tree . . . . these may be extracted by placing the leaf litter in a funnel under the warmth of a 25 W bulb. The insects can be collected in a jam jar in which the funnel stands.

Bees and wasps . . . ensure that they are not disturbed in any way . . . watch them, if possible, at work - . . . . their homes . . . . .

WASTE NOT, WANT NOT

Just to see how much water is wasted by having a faulty washer in a tap, let us see how much water drips out in an hour. Turn on a tap so that it is just dripping. Under the tap put a bucket. Note the time. After exactly one hour turn the tap off. Measure the water collected in the bucket. Pour it into a litre measure : if there is more than a litre, pour the water away and refill the litre measure, and so on. Now, if this amount of water is wasted by having a dripping tap in one hour, can you work out how much water is wasted in one day (24 hours)? If a full-grown human being needs at least two litres of water to drink in a day, how many people could have consumed that wasted water ?

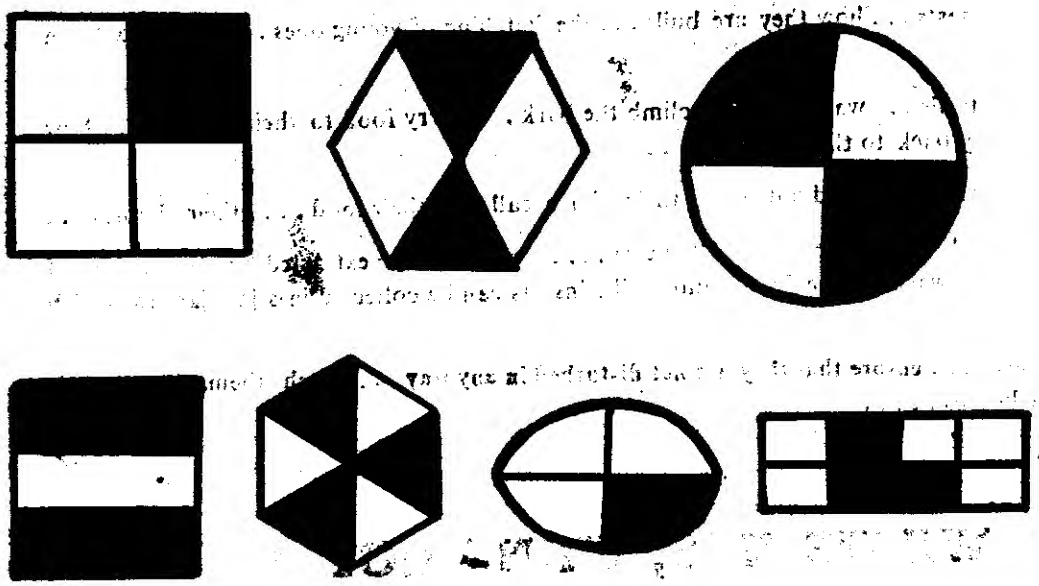
An exercise like this might be used to dramatically bring home to students the need to turn off the water taps after they have had a drink during the school break. Further discussion could focus on keeping the area around the water taps clean and also the need to take only as much as one needs, leaving the rest for other thirsty companions. It might also bring home the fact that chilled water from the water coolers is intended for drinking and not for washing of hands and tiffin boxes!

"Animal Homes" –a 19-page cyclostyled booklet for class III students. Devised and written by Meera Joshi, a teacher at the Convent of Jesus and Mary School, New Delhi. The booklet includes poems, prose stories, crossword and suggestions for activities in language, art and craft and science. Available from Teachers Centre, Springdales School, Pusa Road, New Delhi-110005 at Rs. 2.00 per copy.

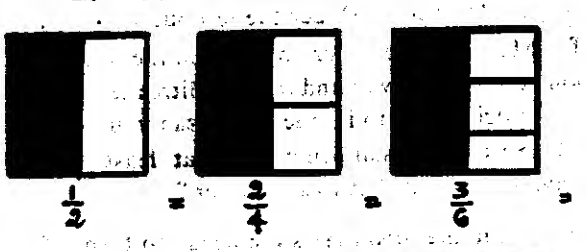
FRACTIONS CAN BE FUN

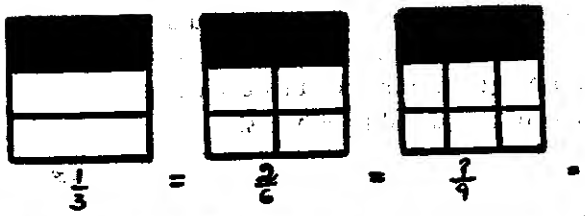
We would be happy if readers of this article would write and let us have more ideas to make the teaching of fractions meaningful and interesting.—Editor

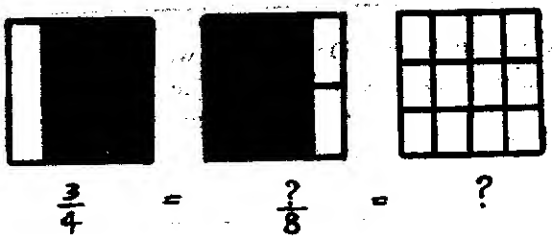
1. What fraction of each figure is shaded?



2. Same-Size Fractions

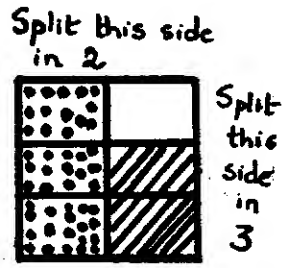






There is the same amount of shading in the figures along each row. Draw and write three more 'same - size' fractions for each row.

3. Adding Fractions.

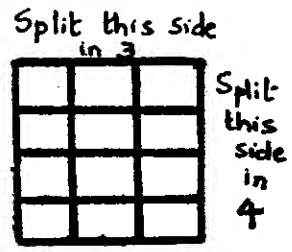


What is $\frac{1}{2}+\frac{1}{3}$? Add the fractions on a square

$\frac{1}{2}=\frac{3}{6}$ (shaded in dots)

$\frac{1}{3}=\frac{2}{6}$ (shaded in lines)

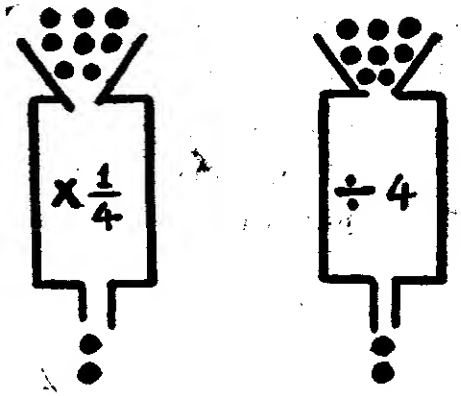
Together they make $\frac{5}{6}$



Add $\frac{1}{3}+\frac{1}{4}$ using the second square.

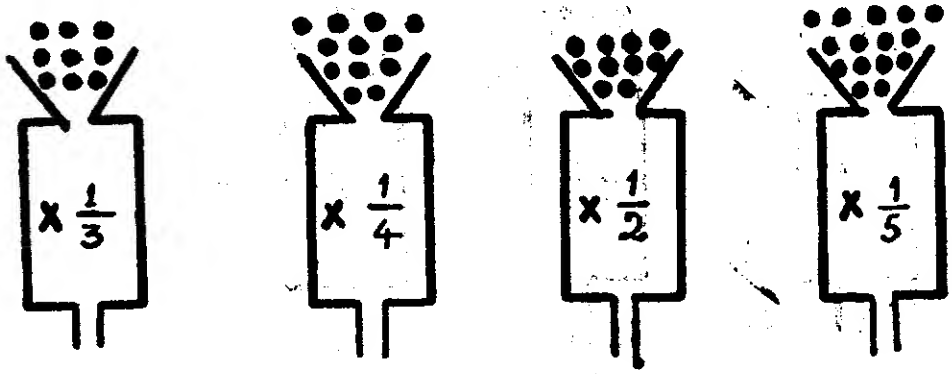
Find $\frac{1}{2}+\frac{1}{5}$ in the same way..

4. Fraction Machines.

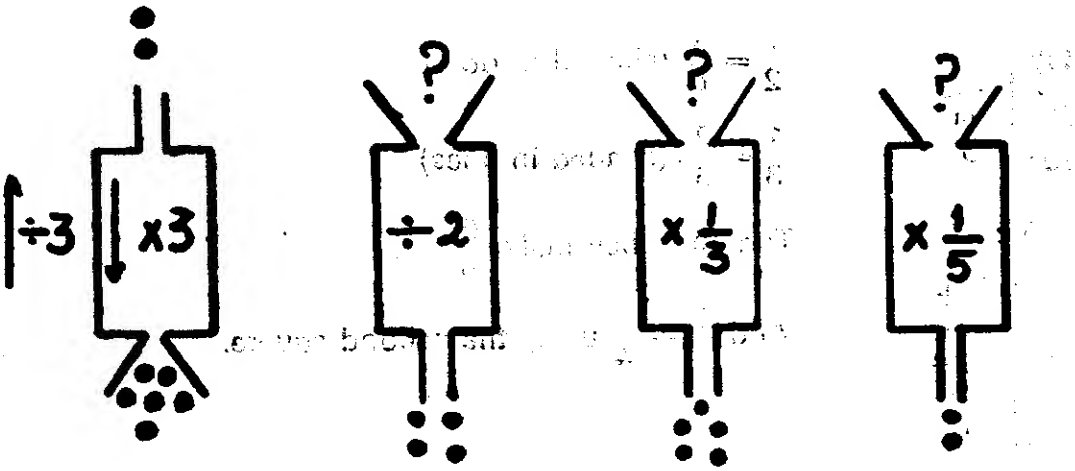


When eight balls are put in..
only two balls come out.
These two machines do the same job.

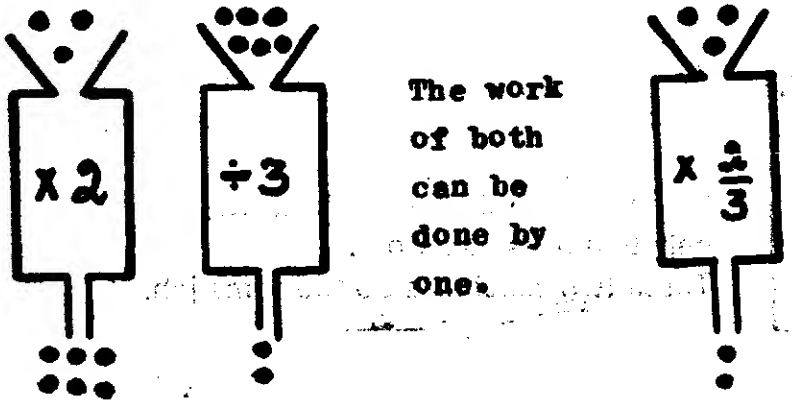
Now find out what comes out of these machines.



The machine can also run in the reverse (or in the opposite way), as shown in the first case. What went into each of the other machines? Run it in reverse and see.



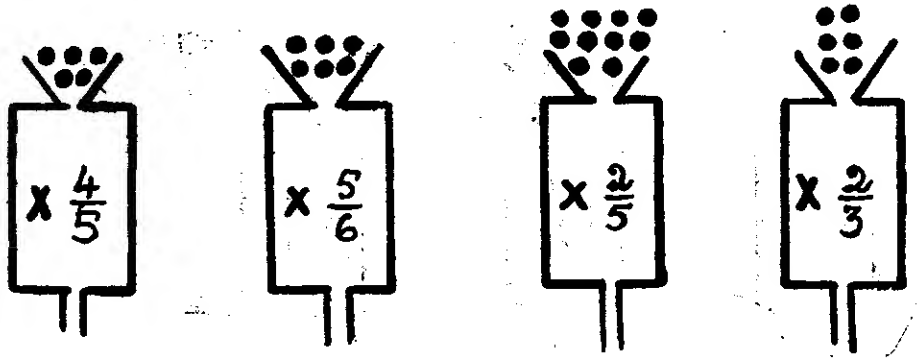
Sometimes two machines can be put together as shown here.



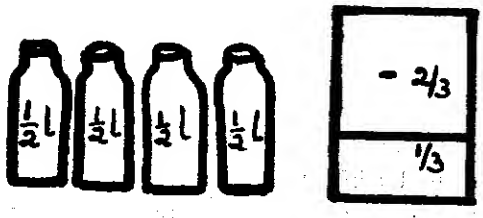
The work of both can be done by one.

For every two that come out, three were put in.

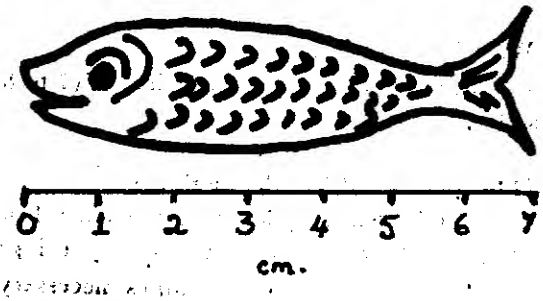
Find out what happens in these machines.



5. Picture Problems.



How much milk will the large can hold ?



This drawing of a fish is one-fourth its actual size.

How long is the fish ?

6. Secret Messages.

Work out each problem Then find the letter in the alphabet that matches your number. This will help you find the secret message.

Problems	Number	Letter
$25 \div 5$	5	B
$\frac{2}{3} \times \frac{3}{2}$	?	?
$\frac{1}{3} \times 60 - 1$	?	?
$\frac{1}{4} \times 100$	?	?
$(20 - 15) \times \frac{1}{5}$	?	?
$12 + \frac{24}{2} - 5$	?	?
$\frac{25}{100} \times 64$	?	?
$(3 \times 9) - \frac{36}{2}$	?	?
$50 \times \frac{1}{20} \times 2$	?	?

(Ideas from Maths 2 & 3 by Michael Holt, Macmillan Education Ltd.)

ORAL TESTING IN SCIENCE IN PRIMARY CLASSES

by **Raj Sahni and Neelam Ohri**

In our school, 'learning by doing' has been put into practice for the teaching of Science in primary classes. You might have read about this in an article written by Raj for an earlier issue of PATHWAYS (Learning Science can be Fun; July 1979). In this article, we would like to share with readers, our experiences in conducting oral tests in Science.

Usually question papers are set at the end of a term or a unit of study, in which a teacher tries to test all aspects of the child's knowledge, interests and understanding of the subject. No matter how efficient we are, such tests are often misleading, especially in the early years of school, where children have difficulty in communicating their ideas clearly. In spite of knowing all the relevant facts, a lack of an adequate written vocabulary makes it impossible for such children to express themselves satisfactorily. Hence written answers are not always the best yardstick for measuring a child's capabilities.

Keeping this in view, we have started in our school, oral testing of primary school children in all subjects—Mathematics, Social Studies, Science and Languages. Children find it easier and more interesting to express themselves freely in the form of simple questions and answers. They remain free of any examination phobia. When questions are asked in a congenial atmosphere, sitting by the side of a teacher, without the fear of being laughed at when answers are incorrect, the child feels secure. He answers most carefully, questioning himself if in doubt and getting a correct answer most of the time.

During the term, while the child is carrying out practical work, his attention is generally centred on the result only. He does not think about facts, often important ones, related to what he is doing. Oral questioning provides us with an opportunity to lead him from one question to another and draw his attention to the link between science and his life experiences. Thus it improves his powers of reasoning. He learns to accept facts which have a soundly reasoned out basis.

Oral testing also gives us time to discover some of the hidden capabilities of a child. These may be overlooked when dealing with a whole class rather than with an individual.

We give here two examples of dialogues between the teacher and a pupil of Class II (7 to 8 years old).

Plants : (Living and Non-living things)

Children have already learnt the parts of a plant and their functions, how to classify things into living and non-living ones, things necessary for plant growth etc. Now to see whether they have crammed the facts or they can really use them in situations, the following dialogue was held ;—

Teacher : (Showing a recently plucked plant with roots to the child) Is it living or non-living ?

Child : (Seeing and thinking) Non-living.

Teacher : But how ?

Child : Because it is unable to take its food from the soil.

Teacher : But you can see some soil still attached to the roots.

Child : (Thinking deeply.....when his eyes suddenly shine) It is living.

Teacher : Why living now?

Child : It is living because it shows that we have plucked it just now and it is still green. If we plant it in soil it will grow.

Teacher : Yes, you are correct but, (showing a green plant without roots) will this plant also grow and is it living ?

Child : No, it will not grow because it does not have roots and it is not living.

Forces

From the chapter concerning different kinds of forces and work done, the child has already done practicals to see different kind of forces like muscular, electrical, magnetic, frictional and gravitational forces. To see whether they can apply this knowledge in daily life the following conversation was held.

Teacher : A child did not wash his soapy hands properly and went in to have a glass of water. As soon as he held the glass, it slipped and fell down. Can you tell me which forces acted on it then ?

Child : (Thinking) gravitational force.

Teacher : How ?

Child : It fell down due to this force.

Teacher : (Showing actions with a glass) It slipped first and then fell down. Why did it slip ?

Child : It slipped because the child had soap on his hands.

Teacher : Then what force was acting between the glass and the slippery hands ?

Child : (Taking the glass into his hands letting it slip a little and thinking deeply) It is due to the force of friction, teacher.

Teacher : Yes, you are correct. But was that force less or more when the glass slipped ?

Child : The force was less, because to lessen the force of friction we make the surface slippery. (He remembered it from the work we had done in the practicals. He gave some more examples himself-like applying grease on machine parts, the surface of a skating rink is smooth and slippery to help in easy skating.)

(Raj Sahni and Neelam Chri work in Sardar Patel Vidyalaya, Delhi.)

THE SPELLING DILEMMA

by **Nirupama Kartik**

Children very often unconsciously address their teachers as 'Mummy'. One wonders how alike we are—teachers and parents. Just as a parent proudly reports the first word the child speaks, so does a teacher share the child's development of a new vocabulary, his first written composition and his early attempts at self-expression. One of the most satisfying rewards of teaching is to see a child grow in his ability to communicate his ideas in speech and writing.

Our aim is to help the child read with ease and express himself clearly and comfortably. However the peculiar phonetic nature of the English language creates a teaching dilemma. Learning how to pronounce new words on the basis of sounds and then writing them is often complicated. As long as the written and spoken language involve the same vocabulary, conflicts are limited ; but this is not the case, especially for children in grades I and II. The five or six-year old of today has a relatively large spoken vocabulary. When he writes it is normal for him to use the words familiar to him in oral usage, some of which contain the spelling irregularities peculiar to the English language.

Any demand for accepted spellings at this initial stage places a serious limitation on a child's willingness to write down his ideas. For this reason, we must accept the application of phonetic

spellings in his early attempts at writing. He is trying to express his ideas using the letters that seem to him to make the proper sounds. Keeping this in mind, the teacher will not be upset when she sees 'could' spelt as 'kud' or 'elifant' instead of 'elephant'. Circles and red marks indicating spelling errors undermine a child's confidence and his interest in writing at this stage.

Although it is unlikely that learning spelling will ever have the same fascination as games, music or painting, some simple games can be used to make this less of a chore. Games provide that little extra motivation to learn spellings, but their duration and timing are important. Any game must not last too long. I almost always explain to the class, right at the start, that each child cannot have a turn on the same day. Some of the games I have found useful, especially in grades I and II are as follows.

i. **Making new words by changing the vowel:**

bat — bet — bit — but
pan — pen— pin—

ii. **Making the word come 'alive' by changing one letter :**

mat — man	cap — cat
pin — pig	cup — pup

iii. **Endless chains :**

This is one game in which the whole class can be involved. It can also be played as a relay race with the class divided into two teams.

rat — tub — bed — den — —

iv. **Completing rhymes :**

A big cat	If you are tall
Sat on a ——. (mat)	You can jump over the ——— ——· (wall),

Rhyming couplets also help children to firmly establish in their minds the spellings of new words they learn.

When it is night	The good old king
We need a light.	Had a golden ring.

v. **Using the blackboard :**

Children in the primary grade feel it is a privilege to write on the blackboard and love doing so. A place should be reserved on the black-board where a child may come and write something whenever he feels like it. I sometimes put up exercises of this kind on the board and leave it to the children to fill in the columns with words of their choice.

words beginning with 'b'	colours	toys	rhyming words

vi **Labelling :**

I have found that this is one of the quickest ways to help children learn the spellings of common words. All objects in the classroom are labelled in bold letters e.g window, door, table, chair, wall, fan .... Besides these, some of the most commonly used words are put up for the children's ready reference — e.g with, there, play, said ....

Frequently I have noticed a child referring to these labels. After a week or two he begins to use and spell the same words correctly, on his own.

vii. **Mnemonic devices** are sometimes interesting and useful. Such devices, which aid the memory, are very personal — they may help some children and may be merely an additional burden to others. They can generally be used from grade III onwards. I have given below a few that may help children (and adults !) with specific difficulties in spelling.

all right	— All right is like all wrong.
balloon	— A balloon is like a ball.
hear	— You have to use your ear to hear.
divide	— The 'v' divides the two i's.

accommodate — Accommodate is big enough to accommodate two m's and two c's.

principal — The principal is a prince of a pal.

bachelor — The bachelor does not like tea ('t').–(commonly mis-spelt as batchelor)

cemetery — Watch the e's in cemetery.

field, receive — 'i' before 'e', except after 'c'.

I give below some samples of the earliest efforts of grade I children. The spellings have been left uncorrected. Behind the story or composition, behind the stumbling search for words is the child and all that he can become. Creative writing is one way in which we, teachers, can seek to understand him.

The first three pieces were written immediately after a visit to the zoo.

* "In the zoo I so an Elifant and a Tyger and Kamel and Duks and Water. We wen theyur for a piknik. I so crocodyl and Raynosores. I was taerd. I kud not cee snaks. I thote I wil kum agin. My teechur brot me theyur."

* "The zoo was nais. I luvd it. I wontid to stei theyr but I kud not I laikd the Jiraf and layn and lepird. Theyr was a tren in the zoo."?

* "I saw a laun. The laun was woking in a kage. It was big. He was eteng. I laik laun the best. He ets 14 kelos meet. I laikd the zoo."

* "Theyar is a moon in the skai. The stars are undur the skai. The son is undur the skai. The skai luks nais. Theyar is a God on the skai."

(Nirupama Kartik teaches in Sardar Patel Vidyalaya, Delhi. Readers will no doubt remember her very interesting article titled 'Hands' which appeared in the February 1980 issue of PATHWAYS. Her interests include children's theatre, painting and drawing. Two of her books, 'Sets' and 'Words' have been published by the Thomson Press in 1979.)

SETTING BEHAVIOURAL OBJECTIVES—V

by **Jose Paul**

In an earlier article of this series (August 1980), we had identified the three areas in which a child develops as the cognitive, affective and psychomotor domains. Subsequently, we have tried to understand in some detail the various steps in the hierarchy of development in the cognitive and affective areas of learning.

One of the most important areas of education, often not given its due attention or importance, is the child's development in the psychomotor domain. One frequently takes it for granted that many of the psychomotor skills are learnt automatically or instinctively as part of the process of physical growth. Perhaps this is true to a limited extent. An infant reacts and learns to turn towards the source of new sounds. A little later on co-ordination between the limbs is achieved and movement of various kinds becomes possible—kicking, crawling, standing up, taking the first independent steps, holding objects and so on. We must realise however the importance of the environment in which the child grows towards these developments. It is well-known that children who are encouraged to explore, move around and be active 'grow up' faster in these respects.

In later years, when the child is in school, other environmental factors come into play. Apart from physical factors, the personalities of the people they come into contact with, influence children. What they learn depends very much on the learning input fed into them by parents, teachers and other people they move with. If we compare two sections of a class containing students who are at the same

level of growth and are required to cover the same course of study, we usually find differences in their performance. These differences may show up in any or all the three areas of learning.

A sample of the psychomotor developments that take place in a child's career at school may include some of these:

* the ability to write
* the ability to handle tools—for drawing, for repairs or in a laboratory
* the ability to play certain games
* the ability to type
* the ability to sing or play musical instruments . . . and so on.

Psychomotor skills can be thought of as the development of various simple movements of the body leading eventually to finely co-ordinated movement. It also includes development and refining of the five basic senses - touch, vision, hearing, taste and smell. It refers to the development of gross body movements such as throwing a ball, swinging a racquet, kicking a football, running a race or swimming. From this level of psychomotor learning the child must be helped towards finely co-ordinated movements like.

* hand and finger movements used in buttoning on a shirt without looking.
* hand-eye co-ordination, as when a jigsaw is being assembled or for typing
* hand-ear co-ordination, as required for playing musical instruments
* hand-eye-foot co-ordination—needed for operating a sewing machine.
* combinations of co-ordinated movements which may be used for activities like driving a car.

Psychomotor developments at a still higher level are non-verbal communication through facial expressions, gestures (acting as a referee in a game), body movements as in dance and certain speech behaviours. Singing a musical scale involves co-ordination between the ear and the vocal chords to produce finely tuned vibrations.

The first step in the ladder of learning of such skills is imitation on the part of the child. This implies that the teacher must set up a suitable demonstration which the child can learn from. This demonstration or model is the key to learning at this stage. It needs to be repeated, if needed, until the imitation becomes closest to the action performed by the teacher. It is important to remember that the learning units must be small, so that the child obtains the satisfaction of completing his task well. Frustration at this stage may block further learning.

The sample of objectives given here will make these points clear.

* The child will be able to reproduce a reasonable copy of geometrical figures shown to him by the teacher.
* The child will be able to copy reasonably, the alphabets written by the teacher on the blackboard.
* The child will be able to reproduce the musical notes sung by the teacher with reasonable correctness.
* The child will be able to fit and use scientific apparatus (bore a cork, bend a delivery tube and fit it into a flask etc.) after being shown how by the teacher.
* The child will be able to place his fingers in correct positions on the keys of the typewriter and strike them, as demonstrated by the teacher.

Obviously, since the child is imitating a teacher, **the quality of the demonstration needs to be good.** The teacher sets the example; whether it is a matter of drawing accurate geometrical figures, writing neatly, singing correctly or handling apparatus with care.

Once the child has learnt to imitate the action demonstrated, the next stage he reaches for is **manipulation.** This may be compared with practice in order to perfect a skill. Here it is important that we, as teachers, resist the temptation to make things too easy for the child. Doing the job for him or helping him too much will not be in his best interests. We should give him verbal directions, encourage him and let him make his own mistakes. **The child should carry out the activity himself over and over again.** This **repetition** is an important aspect of the practice. This is true whether in reference to developing a good handwriting, drawing neat figures or playing a musical instrument. The objectives now are :

* The child will practise drawing common geometrical figures himself, without the aid of the teacher.
* The child will practise writing the letters of the alphabet neatly, by himself.
* The child will practise musical tunes taught to him, on his own.
* The child will practise the scientific activities taught to him, on his own.
* The child will practise typing passages of a suitable standard on his own.

This practice leads to **precision** and the above objectives can be made more measurable by indicating the degree of precision required. This may be done by specifying the number of permissible mistakes or the time required to carry out an activity or the kind of neatness and accuracy required in diagrams etc. For example the last of the objectives might become.

* The child will be able to type out a given passage of appropriate standard in twenty minutes with not more than two mistakes.

Reaching this stage gives the child a great deal of self-confidence. As a result he starts trying out on his own variations of the work he has learnt to do. Gradually his personality begins to influence his attitudes and his style of work. When two pupils at the same level of technical achievement play a musical instrument, the teacher can usually identify them individually. The same is true of handwriting. The child is expressing himself, his personality, through his skill. This phase is called **articulation.** The teacher's role lies in encouraging this process, permitting the student to project his individuality and giving appreciation when it is due.

The final stage of psychomotor learning is called **habitualisation** wherein the skill becomes deeply ingrained in the child, permitting him to carry out the action automatically and often without paying it conscious attention. Examples of this include.

* knitting, even complicated paterns, while watching a film
* typing effortlessly, while taking part in a conversation
* playing an instrument well without concentrating on the mechanics of sound production.

I have attempted to show these stages of psychomotor learning in the following example relating to music :

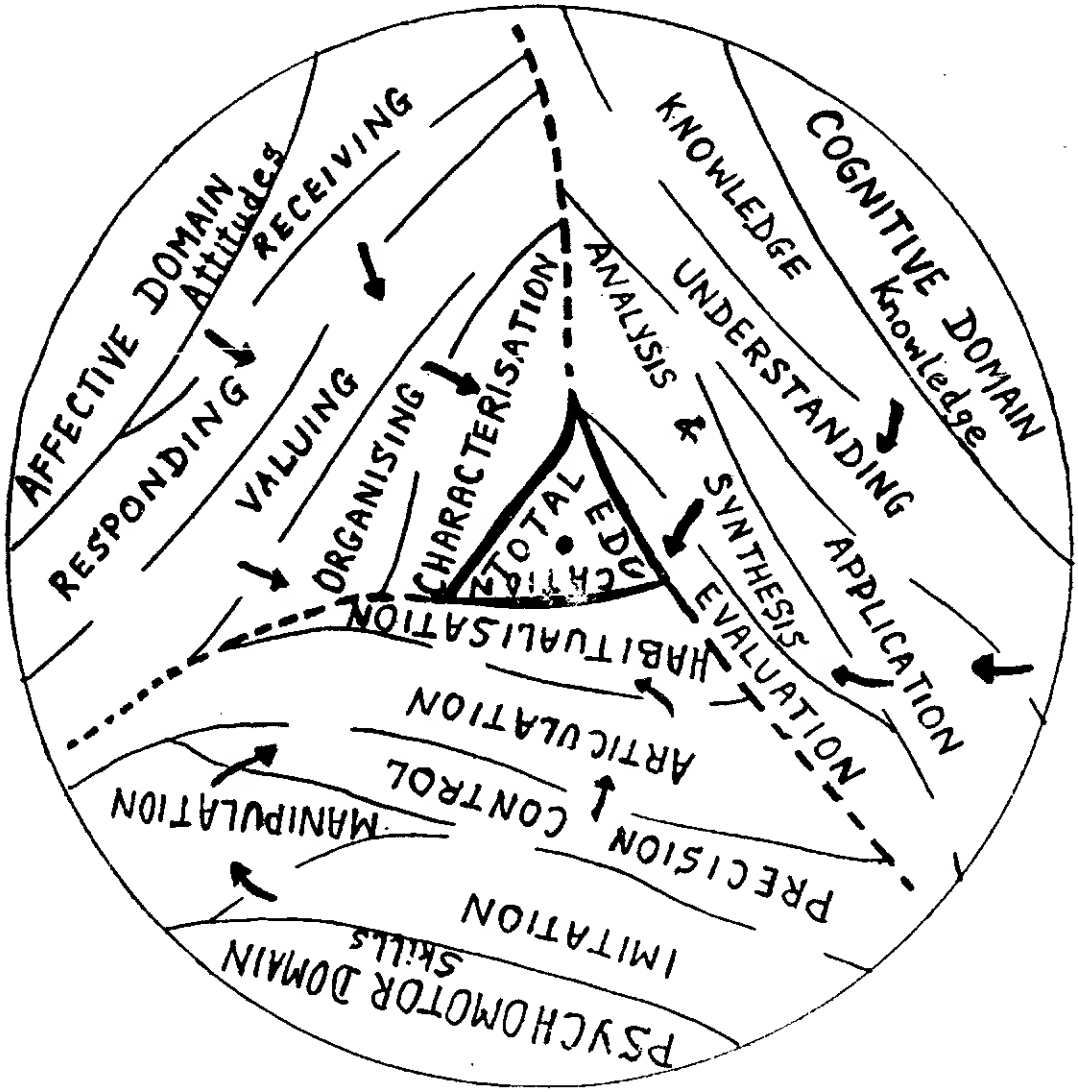
* The child will **imitate** the actions of the teacher in learning to play single notes forming a scale, on the guitar.
* The child will himself **practise** the above actions, so that he is able to play the scale correctly without help from the teacher.
* The child will be able to play correctly the notes of the scale in different sequences (tunes) as

specified. (precision)

- The child will be able to play simple tunes correctly and with expression or feeling. (**articulation**) (He can express his moods through his music.)
- The child will be able to play known tunes on his instrument effortlessly without appreciable concentration on the mechanics of playing.

The psychomotor domain is of importance to all teachers. For a kindergarten teacher, an understanding of these objectives helps in guiding her charges towards the rigours of formal education—writing, reading, correct classroom behaviour and so on. They are relevant to the teacher of physical education in planning the child's development in sports, athletics and games. They concern the teachers of art and craft, dramatics and music. They are no less important to teachers of science, mathematics and the humanities. They help them to understand what they may expect of the children they teach. They help them to grade their teaching-learning sessions in accordance with the hierarchy of learning.

As I have said earlier in this series of articles neither the three domains of learning nor the steps in each domain can be kept in separate compartments. Growth in any one influences the child's behaviour and growth in another. This diagram attempts to represent the inter-relationship between these areas.



SPOT TESTS FOR HISTORY AND GEOGRAPHY

by **Malini Rajendran**

'Spot' tests are generally used in most schools as part of the Biology practical examination, accounting for perhaps twenty-five percent of the marks. The same concept can be applied to subjects like History and Geography.

Such a test was first conducted for the 5th standard, initially on an experimental basis, at the Padma Seshadri Bala Bhavan School, Madras, in 1975. It proved both popular and useful to teachers as well as students. As a result it has become an integral part of the terminal and annual examination for all classes—5th standard and above.

As it was a new idea, the very first test set up was a simple one. Pictures from familiar books, which the students could identify easily were used as 'spots'. The emphasis was on the method of testing rather than on the scoring of marks. Ten selected pictures (or 'spots') were displayed, the other parts of the page being blocked out. Each was labelled A,B,C . . . up to J. Each child was given an answer sheet. After routine examination procedures were completed, the child was stationed in front of one of the test items. Only ten children could take the test at a time as only ten 'spots' had been arranged. At each 'spot' a child was allowed two minutes during which it had to be identified and two or three lines written about it. The time was checked with a stop-clock. At intervals of every two minutes a bell was sounded and the students were told to move on to the next test item. This was repeated until each student had seen all the ten 'spots'. An additional two minutes was given at the end for overall revision and completion of any sentences. Students were not however given a second chance of seeing any of the 'spots'.

Before starting, it is necessary to brief the students about the method of recording their answers. Each test item is to be identified by its code letter—A, B, C . . . . J. A student starting at 'J' will proceed to number his answers in the same order in which he sees the test items; namely J,A,B,C, ... up to I.

The teacher evaluating the answers sheets needs to remember that each 'spot' carries no more than 2½ marks and that in the given time of two minutes, a student should not be expected to write more than three or four lines, indicating only the salient or most important points. The student is required to (i) identify the 'spot' correctly.

(ii) place it in the correct period or time zone —for History items.

(iii) place it in the correct location, area or country—for Geography items

(iv) write down the special features connected with the 'spot'.

To give readers an idea, here is a short list of some test items which were used. Given alongside are possible answers (in point form).

* Mohenjo-Daro Seal	Indus Valley Civilisation Clay tablets used as seals for personal identification, perhaps also a means of communication.
* Picture of bronze statue of Nataraja	Chola Period. Nataraja Bronze casting and sculptures common.

* Desert Land, cacti	Hot, very little water. Vegetation adapts to suit the climate.
* Igloo	Home of Eskimo, made of ice blocks. Seen in the frozen North near Arctic Circle. Protects him from cold winds.
* Diagram of Water Cycle	Shows how rain is formed—evaporation from sea, water vapour rises and cools, condenses to form rain clouds.
* Taj Mahal	Seen in Agra. Built by Moghul emperor, Shah Jehan as a tomb for his wife Mumtaz Mahal.

In the beginning, we used only pictures as 'spots'. Later, as both students and teachers became more adept at identification and evaluation respectively, the nature of the 'spots' became more varied. Statues, figurines, wood carvings, panels, stamps depicting both people and events, plasticine models, full size paintings, photographs, newspaper and magazine clippings, advertisements, rocks, stones, mineral pieces and even product labels were used. It must be mentioned here that History and Geography were not treated as separate subjects. The average test contained a balanced assortment of 'spots' pertaining to both fields. This kept the children alert and also reminded them of the links between the two subjects.

The aim of this kind of test is to judge the practical application of some of the principles taught in theory, and to see if the child can relate and recognise what is taught in class with a real-life situation. It also attempts to assess the child's ability to interpret data made available to him. As a result of this type of testing, the illustrations in textbooks became more useful and meaningful. Children developed a habit of extracting much information and detail by looking closely at photographs, maps and other objects. Practice developed these abilities further. The learning process was enhanced by the visual, and sometimes audio-visual component introduced as a result of this kind of study.

'Malini Rajendran a Science graduate, has worked as a field trip organiser at the Padma Seshadri Bala Bhavan School, Madras from 1975-1976. This involved her in the planning, preparation and execution of a wide variety of 'projects' at all levels. She has also taught at the Harrington House School in Madras. Her other interests include theatre, debating, music and literature'.

USING A WHEEL FOR MEASUREMENT

Make a measuring wheel with a circular piece of wood or hardboard having a radius of approximately 160 cm. Make a handle from a one metre length of wood, about 4 cm square. Fix the handle to the wheel using a bolt about 7 cm long. This should leave the wheel free to rotate around the bolt One revolution of the wheel will measure about one metre. Children can make a mark on the circumference of the wheel and can then count the number of times it turns within a given distance. This helps them measure distances in metres.

Older children could extend the idea further. The circumference of a bicycle wheel could be measured using a measuring tape. The wheel can then be used to measure a variety of distances in the school..... the length of a road, the dimensions of a games field, the distance between two rooms and so on. It provides opportunities for practice in the metric system of measuring length, simple calculations involving units and perhaps decimals.

A LETTER OF INTRODUCTION

A new school year has started and we thought that it would be nice to share with our readers this letter from a father to his son's teacher.

—Editor,

Dear Teacher,

My young son starts school today—it is all going to be strange and new to him for a while and I wish you would treat him gently.

You see, up to now, he has been the central attraction in our home. His mother has always been ready to repair his wounds and I have always been handy to soothe his feelings. But now, things are going to be different. This morning, he is going to walk down the front steps, wave his hands and start out on a great adventure.

It is an adventure that might take him across continents—it is an adventure that will probably include wars, tragedy and sorrow. To live this life in the world he has to live in, will require faith, love and courage. So, dear teacher, will you please take him by his hand and teach him the things he will have to know. Teach him—but gently, if you can. He will have to learn that all men are not just, that all men are not true. But teach him also, that for every scoundrel, there is a hero—that for every crooked politician, there is a dedicated leader.

Teach him that for every enemy, there is a friend. It will take time, teacher, I know, but teach him if you can, that 10 paise earned is of far more value than a rupee found—teach him to learn how to gracefully lose—and enjoy winning—when he does win.

Steer him away from envy, if you can and teach him the secret of quiet laughter. Let him learn early that bullies are the easiest people to lick. Teach him if you can, the wonder of books—but also give him time to ponder the eternal mystery of birds in the sky, bees in the sun and the flowers on a green hill.

In school, teacher, teach him it is far more honourable to fail than to cheat. Teach him to have faith in his own ideas, even if everyone tells him they are wrong. Teach him to be gentle with gentle people and tough with tough people.

Try to give my son the strength not to follow the crowd when everyone else is doing it—teach him to listen to everyone—but teach him also to filter all that he hears on a screen of truth and take only the good that comes through. Teach him—if you can—how to laugh when he is sad—teach him there is no shame in tears—teach him there can be glory in failure and despair in success. Teach him to scoff at cynics.

Teach him to sell his talents and brains to the highest bidders, but never to put a price tag on his heart and soul. Teach him to close his ears to a howling mob and to stand and fight if he thinks he is right. Teach him gently, dear teacher, but don't spoil him because only the test of fire makes fine steel.

Let him have the courage to be impatient—let him have the patience to be brave. Teach him always to have sublime faith in himself, because then he will always have sublime faith in mankind and God.

This is a big order, teacher, but see what you can do—he is such a nice little boy - and he is my son.

Dad.

(Does any reader know the source of this ? Please write and tell us.)

STRANGE SIMILES :

Do you know just how little truth there is in some of the commonly used similes of the English Language ?

***As filthy as a pig** — Pigs, if given a choice will keep themselves cleaner than most other farm animals. They actually wallow in mud to keep cool, because they lack a perspiration system.

***As wise as an owl** — Is this perhaps because of the owl's large eyes ? Laboratory tests and experiments have found that geese, crows and ravens are 'smarter'.

***As busy as a bee** — not wholly true. The female worker bees are busy, it is true. They feed and look after the male drones whose only role in the hive is to mate with the queen bee.

***As blind as a bat** — Bats are not blind, though some of them cannot see very well in bright sunlight. Their high-pitched squeaks are reflected from obstacles in their path. This helps them to navigate very well, even at night.

YOUR ATTENTION PLEASE

PATHWAYs is issued four times a year—in February, April, August and November. **The annual subscription is Rs. 6/- for all readers, both in Delhi and outside. Individual copies may be obtained for Rs. 1.50 plus postag.** Please send your Money Orders to the Educational Planning Group 4 Raj Niwas, New Delhi-110054

Owing to frequent losses in the post, we have decided to post individual copies to teachers of Delhi Schools. When you renew your subscription this year, please make sure to let us have your correct residential address, including the Pin Code.

Contributions from teachers describing new ideas tried out their problems and other experiences are most welcome. Please send them to me before the 10th of the preceding month.

—Gayatri Moorthy

SOMETHING TO THINK ABOUT

Joy in one's work is the consumate tool without which the work may be done indeed, but without which the work will always be done slowly, clumsily and without its finest perfectness. Men who do their work w thout enjoying it are like men carving statues with hatchets. The statue may get carved perhaps, and is a monument forever to the dogged perseverance of the artist : but their is a perpetual waste of toil, and there is no fine result in the end.

—Phillips Brooks

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